Model Viva Questions for "Analog Electronics"

Common to: ET&T IV SEM

Title of the Practical: Measurement of Different Characteristics of an OP-AMP Loop configuration (a) Output resistance "Ro" (b) Diff. Input Resistance "Ri"

Q 1 what do you mean by operational –amplifier?

A1 an operational amplifier is a direct- coupled, high gain amplifier used for some mathematical-operation such as addition, substraction, multiplication and integration.

Q 2 List the ideal characteristics of an op-amp?

A2 An ideal-opamp would have the following characteristics:-

1 Infinite voltage gain 2 Infinite input resistance
3 Zero o/p resistance 4 Zero o/p voltage when (i/p voltage is zero)
5 Infinite Band with 6 infinite common mode Rejection ratio
7 infinite slew rates.

Q 3 what are the main features of Ics 741?

A3 the main features of Ics 741 are:-

1 No external frequency compensation required.
2 short circuit protection.
3 offset null capability.
4 large common mode and differential voltage range
5 low power consumption
6 No latch up problem

Q 4 what do you mean by input offset current?

A 4 the algebraic difference between the current in the inverting terminals is as know as Input offset current.

Q 5 what do you mean by input offset voltage?

A5 Input offset voltage that must be applied between the two input terminal of an Op-amp to null the output.

Q 6 what do you mean by input biased current?

A6 input biased current is the average of the current that flow into the inverting and Non Inverting input terminals of the op-amps.

Q 7 what do you mean by differential input resistance?

A7 differential input resistance is the equivalent resistance that can be measured at either the inverting and non inverting input terminal with the other terminal connected to ground.

Q 8 what do you mean common mode rejection ratio (CMMR).

A8 common mode rejection ratio define as "it is the ratio of the differential voltage Gain to the common mode gain of an op-amp.

CMMR= differential gain/ common mode gain

Q 9 what do you mean by SVRR (supply voltage rejection ratio).

A9 the change in an op-amp input –offset voltage, caused by variation in supply voltage is called supply voltage rejection ratio (SVRR).

Q 10 what do you mean by output resistance of an op-amp?

A10 the output resistance is the equivalent resistance that can be measured between the Terminal of the op-amp and ground.

Title of the Practical: Measurement of Differential Characteristics of an OP-AMP loop configuration (a) Voltage Gain (b) Unity Gain Bandwidth

Q 1 what do you mean by slew rate of an op-amp.?
A1 slew rate is the maximum rate of change of output voltage per unit of time.

Q 2 what do you mean by gain band width product of an op-amp?
A2 the gain bandwidth of an op-amp is the "bandwidth when the voltage gain is unity".

Q 3 what do you mean by an open loop configuration of an op-amp?
A3 the open loop configuration of an op-amp indicate the No connection, exist between
The output signal is not fed-back in any from into the input.

Q 4 How many configuration in open-loop op-amp configuration?
A 4 there are three open-loop op-amp configurations:
1 Differential –amplifier.
2 Inverting amplifier
3 Non- inverting amplifier

Q 5 what do you mean by voltage follower?
A 5 the lowest gain that can be obtained from a non-inverting amplifier with feed back Is 1. When the non-inverting amplifier is configured for unity, it is called a voltage Follower.

Q 6 what do you mean by a comparator?
A 6. Comparator is an open-loop op-amplifier which compares the input voltage at other one terminal to a reference voltage at other terminal and produce a voltage at their output terminal.

Q 7 what do you mean by a zero-crossing detector?
A 7. Zero-detector is a comparator in which a zero reference is applied at their non-inverting terminal. Zero-crossing detector switches their output from one state to another state if the input voltage crosses the zero point.

Q 8 what do mean by a Schmitt trigger?
A8. Schmitt trigger is a type of comparator which uses positive feedback. Schmitt trigger convert an sinusoidal signal to a square wave signal.

Q 9 how many types of Schmitt trigger used?
A 9. There are two types Schmitt trigger are used.
1. Inverting Schmitt trigger.
2. Non-inverting Schmitt trigger.

Q10 what do you mean by threshold voltage of Schmitt trigger?
A10. The input voltage of Schmitt trigger for which the Schmitt trigger changes their output is called threshold voltage.

Title of the Practical: Measurement of Differential Characteristics of an OP-AMP (a) Input offset voltage

Q1what do you mean by hysteresis of Schmitt trigger?
A1. Hysteresis is the voltage difference between turn-on and turn-off voltage of comparator.

Q2 Explain the main effect of a hysteresis?
A2. The main effect of hysteresis are-

1. It improves the noise immunity.
2. It reduces the response time.
3. It reduces the false triggering.
4. When hysteresis increases then sensitivity reduce.

Q3 what do you mean by a voltage to frequency converter?
A3. A device which convert an analog voltage into a pulse signal which frequency is proportional to the applied input voltage.

Q4 what is the function of frequency to voltage converter?
A4. A device which convert the frequency of the input signal into an proportional output voltage.

Q5what are main application of frequency to voltage converter?
A5. The main applications of these are follows-

1. It is used to control the speed of motor.
2. It is used for rotational measurement.
3. It is used for digital to analog conversion.

Q6 Explain the Timer IC-555?
A6. IC-555 is timer IC which is used in a stable, multivibrator, square wave generator, triangular wave generator, pulse modulator and pulse detector circuit.

Q7 Explain the function of phase detector?
A7. The main function of phase detector is to compare the signal with feedback voltage and produce a D.C. output voltage
Q8. Define an Integrated circuit.
A8 An integrated circuit(IC) is a miniature ,low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon. The active components are transistors and diodes and passive components are resistors and capacitors.

Q9Explain the main feature of IC-723.
A9. The main feature of IC-723 are-

1. Input voltage (9.5 Volt-40 volt)
2. Regulated output voltage (2 to 37 v)
3. Maximum load current = 150 ma.
4. Internal power dissipation is 800 mvolt.

Q10 what is function of pulse width modulator?
A10. In pulse width modulator the width of the output pulse is varying according to the variation in the amplitude of modulating signal

Title of the Practical: Offset Nullification with: (a) External Biasing for Inverting OP-AMP (b) External Biasing for Non-Inverting OP-AMP

Q1.What are the two important properties of SiO2?

A1.1.SiO2 is an extremely hard protective coating & is unaffected by almost all reagents except by hydrochloric acid. Thus it stands against any contamination.

2. By selective etching of SiO2, diffusion of impurities through carefully defined Windows in the SiO2 can be accomplished to fabricate various components.

Q2.Explain the process of oxidation.

A2.The silicon wafers are stacked up in a quartz boat & then inserted into quartz furnace tube. The Si wafers are raised to a high temperature in the range of 950 to 1150oC & at the same time, exposed to a gas containing O2 or H2O or both. The chemical action is

$$Si + 2H_2O \longrightarrow Si O_2 + 2H_2$$

Q3..What is meant by molecular beam epitaxy (MBE)?

A3. In the molecular beam epitaxy, silicon along with dopants is evaporated. The evaporated species are transported at a relatively high velocity in a vacuum to the substrate. The relatively low vapor pressure of silicon & the dopants ensures condensation on a low temperature substrate. Usually, silicon MBE is performed under ultra high vacuum (UHV) condition of 10-8 to 10-10 Torr.

Q4.What is the advantages of Molecular Beam Epitaxy (MBE)?

A4 (i) It is a low temperature process, useful for VLSI. This minimizes out diffusion & autodoping.

(ii) It allows precise control of doping& permits complicated profiles to be generated.

(iii)Linear doping profile desirable for varactor diode in FM can be obtained with MBE.

(iv) Wider choice of dopants can be used.

Q5. What is oxidation induced defects in semi conductor?

A5.1.Stacking faults

2. Oxide isolation defects

Stacking faults:

Structural defects in the silicon lattice are called oxidation induced stacking faults. The growth of stacking faults is a strong function of substrate orientation, conductivity type & defect nuclei present. The stacking faults formation can be suppressed by the addition of HCl.

Oxide isolation defects :

The stress along the edges of an oxidized area produces severe damage in the silicon. Such defects results in increased leakage in nearby devices. High temperatures (around 950oC) will prevent stress induced defect formation.

Q6.What is bird's beak?

A.6 In local oxidation process, the oxidation of silicon proceeds slightly under the nitride as well. Also, a large mismatch in the thermal expansion co-efficient of Si3N4 & Silicon results in damage to the semi conductor during local oxidation. This damage can be greatly reduced by growing a thin layer of SiO2 prior to placement of the Si3N4 mask. Typically 100 to 200Ao is used for this purpose. Unfortunately, this greatly enhances the penetration of oxide under the nitride masked regions, resulting in oxide configurations called bird's beak.

Q7.What is lithography?

A7 Lithography is a process by which the pattern appearing on the mask is transferred to the wafer. It involves two steps: the first step requires applying a few drops of photo resist to the surface of the wafer & the second step is spinning the surface to get an even coating of the photo resist across the surface of the wafer.

Q8.What is the different types of lithography? What is optical lithography?

A8 The different types of lithography are:

1. Photolithography
2. Electron beam lithography
3. X ray beam lithography
4. Ion beam lithography

Q9.What is the two processes involved in photolithography?

A9 a) Making a photographic mask:
The development of photographic mask involves the preparation of initial artwork and its reduction, decomposition of initial artwork or layout into several mask layers.
b) Photo etching
Photo etching is used for the removal of SiO_2 from desired regions so that the desired impurities can be diffused.

Q10.Distinguish between dry etching & wet etching.
A10 Dry etching Wet etching
1. Gaseous mixture is used as the chemical reagent. Chemical reagents used are in the liquid form.
2. Smaller line openings (1μm) are possible with dry etching Line opening are larger. (> 1μm)
3. It produces straight walled etching process. It produces patterns with undercutting.

Title of the Practical: Inverting Amplifier (a) AC Analysis (b) DC Analysis (c) Unity Gain

Q1.What is meant by reactive plasma etching?
A1 The term reactive plasma is meant to describe a discharge in which ionization & Fragmentation of gases takes place& produce chemically active plasma species, frequently Oxidizers and reducing agents. Such plasmas are reactive both in the gas phase & with Solid surfaces exposed to them. When these interactions are used to form volatile products so that material is removed or etching of material form surfaces that are not masked to Form lithographic patterns, the technique are known as reactive plasma etching.

Q2.What are isotropic & anisotropic etching processes?
A2 Isotropic etching is a wet etching process which involves undercutting. Anisotropic etching is a dry etching process which provides straight walled patterns.

Q3.Define diffusion.
A3 The process of introducing impurities into selected regions of a silicon wafer is Called diffusion. The rate at which various impurities diffuse into the silicon will be of the order of 1μm/hr at the temperature range of 900oC to 1100oC .The impurity atoms have the tendency to move from regions of higher concentrations to lower concentrations.

Q4.What is dielectric isolation?
A4 In dielectric isolation, a layer of solid dielectric such as SiO2 or ruby completely Surrounds each components thereby producing isolation, both electrical & physical. This Isolating dielectric layer is thick enough so that its associated capacitance is negligible. Also, it is possible to fabricate both pnp & npn transistors within the same silicon substrate.

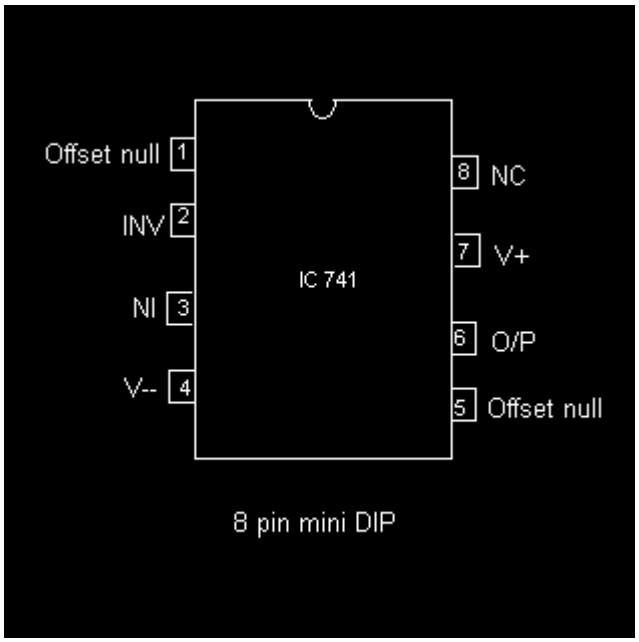
Q5. What are the advantages of ion implantation technique?
A5.1It is performed at low temperature. Therefore, previously diffused regions have a lesser tendency for lateral spreading.
2. In diffusion process, temperature has to be controlled over a large area inside the oven, whereas in ion implantation process, accelerating potential & beam content are dielectrically controlled from outside.

Q6.What is metallization?
A6 The process of producing a thin metal film layer that will serve to make interconnection of the various components on the chip is called metallization.

Q7.What are the advantages of ICs over discrete circuits.
A7 1. Minimization & hence increased equipment density.
2. Cost reduction due to batch processing.
3. Increased system reliability
4. Improved functional performance.
5. Matched devices.
6. Increased operating speeds
7. Reduction in power consumption

Q8. What is OPAMP?
A8. An operational amplifier is a direct coupled high gain amplifier consisting of one or more differential amplifiers, followed by a level translator and an output stage. It is a versatile device that can be used to amplify ac as well as dc input signals & designed for computing mathematical functions such as addition, subtraction ,multiplication, integration & differentiation.

Q9.Draw the pin configuration of IC741.
A9.



Q10. List out the ideal characteristics of OPAMP?
A10 (i) Open loop gain infinite
(ii)Input impedance infinite
(iii)Output impedance low
(iv)Bandwidth infinite
(v)Zero offset, ie, VO=0 when V1=V2=0

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Title of the Practical: Sample and Hold circuit operation

Q.1 what do you mean by sample and hold circuit?
A.1A sample and hold circuit is an analog device that samples (captures, grabs) the voltage of a continuously varying analog signal and holds (locks, freezes) its value at a constant level for a specified minimal period of time.

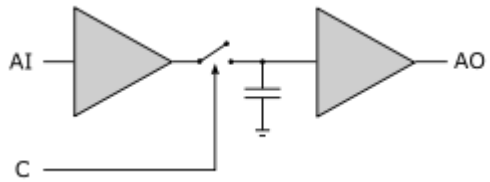
Q.2 what is the use sample and hold circuit?
A.2 Sample and hold circuits are typically used in analog-to-digital converters to eliminate variations in input signal that can corrupt the conversion process.

Q.3 what are the component used in sample and hold circuit?
A.3 A typical sample and hold circuit stores electric charge in a capacitor and contains at least one fast FET switch and at least one operational amplifier.

Q.4 what is the function of buffer amplifier in sample and hold circuit?
A.4 The buffer amplifier charges or discharges the capacitor so that the voltage across the capacitor is practically equal, or proportional to, input voltage.

Q.5 explains the function sample and hold circuit in Hold mode?
A.5 In hold mode the switch disconnects the capacitor from the buffer. The capacitor is invariably discharged by its own leakage currents and useful load currents, which makes the circuit inherently volatile

Q.6 Draw the circuit diagram of sample and hold circuit?
A.6 the circuit diagram of sample and hold circuit is shown in figure:



A simplified sample and hold circuit diagram

Q.7 what is the function of FET used in sample and hold circuit?
A.7 The FET is used as a switch in sample and hold circuit.

Q.8 what do you mean by sample rate?
A.8 The number of times an analog signal is measured (sampled) per second. The unit of sample rate is "samples per second". This is often expressed in kilohertz (kHz). For example, "CD quality" sound has a sample rate of 44 kHz.

Q.9 what is the range of capacitor use in sample and hold circuit?
A.9 In the circuit, the storage capacitor (C1) value is only 200pF. Larger value capacitors give longer “hold” periods but with slower slew rates.
Q.10 what happened if the value capacitor is increased in sample and hold circuit?
A10. If we increased C to 2000pF, the “hold-droop” rate will decrease to 0.085uV/us, and the slew rate would decrease to 0.25V/us.

Title of the Practical: Phase lock loop as frequency multiplier

Q1 what is function of pulse width modulator?
A1. In pulse width modulator the width of the output pulse is varying according to the variation in the amplitude of modulating signal.

Q2 what do you mean by PLL?
A2. PLL is a close- loop- system which is used to track a system.

Q3 Explain the main component PLL?
A3. The main component of PLL are-
1. Phase detector. 2. Low pass filter. 3. Error amplifier. 4. Voltage control oscillator.

Q4 Explain the function of phase detector?
A4. The main function of phase detector is to compare the signal with feedback voltage and produce a D.C. output voltage.

Q5 what do you mean by lock range of PLL?
A5. The range of input frequency for which PLL maintain lock is called lock range.

Q6 Explain the types of PLL?
A6. Their are two types of PLL-
1. First order PLL 2.Second order PLL.

Q7 Explain 1st order PLL?
A7. In first-order PLL the output of the phase detectors linear-relation with phase difference.
In first order PLL, phase detector and fitter block connected in cascade and PLL is in locked.

Q8 Explain the function of loop filter?
A8. The main function of loop filter are-
1. It improve the interference rejection
2. It reduces/eliminate the high frequency error component.
3. It also provide short term memory for PLL
4. It controls the transient and capture response

Q9 what are the main application of PLL?
A9. The main application of PLL are-
1. It is used in frequency demodulation.
2. It is used in a phase shifter.
3. It is used as a signal synchronizer.
4. It is used in tracking filter.
5. It is used in frequency division and multiplication.

Q.10 what is the value of pulse drop during the hold interval in sample and hold circuit?
A.10 Pulse “droop” during the hold interval is 170pA/200pF which is 0.85uV/us (i.e., 170pA/200pF), this 170pA represents the typical leakage current

Title of the Practical: Signal generator using OP-AMP / Timer IC (a) Triangular wave generator

Q1.what is the different kinds of packages of IC741?

A1 a) Metal can (TO) package
B) Dual-in-line package
c) Flat package or flat pack

Q2 Explain the function of each pin of timer IC?

A2. These are follows-

1. Ground pin- It is ground pin which connect the supply voltage into ground terminal.
2. Trigger pin- This pin is used for triggering the timer IC-555.
3. Output pin- This pin is connected to the output load and it is connected between ground and output pin.
4. Reset pin- This pin is used to to reset the timer IC-555. If timer is resetted then a –ve voltage is applied into pin no. 4.
5. Control pin- if a modulated pulse is required then an AC signal is applied into pin no. 5 otherwise this pin is connected to ground.
6. Threshold pin- It is non inverting terminal of the upper if the voltage at this terminal is greater than 2/3 vcc then output of upper comparator is high.
7. Discharge pin- If the voltage at pin 7 is equal to 2/3 Vcc then output voltage is zero.
8. Supply pin- This pin used to connect a supply +Vcc to timer –IC-555.

Q3Explain the main feature of IC-723.

A3. The main feature of IC-723 are-

1 Input voltage (9.5 Volt-40 volts)
2 Regulated output voltages (2 to 37 v)
3 Maximum load current = 150 ma.
4 Internal power dissipation is 800 mvolt.
5 Short circuit protection.
6 Very low temperature drift.
7 High ripple rejection.

Q4. Define an Integrated circuit.

A4 An integrated circuit(IC) is a miniature, low cost electronic circuit consisting of active and passive components fabricated together on a single crystal of silicon. The active components are transistors and diodes and passive components are resistors and capacitors.

Q.5.What is the basic processes involved in fabricating ICs using planar technology?

A5. 1. Silicon wafer (substrate) preparation
2. Epitaxial growth
3. Oxidation
4. Photolithography
5. Diffusion
6. Ion implantation
7. Isolation technique
8. Metallization
9. Assembly processing & packaging

Q6 .List out the steps used in the preparation of Si – wafers.

A6.1.Crystal growth &doping
2. Ingot trimming & grinding
3. Ingot slicing
4. Wafer policing & etching
5. Wafer cleaning

Q7.write the basic chemical reaction in the epitaxial growth process of pure silicon.

A8. The basic chemical reaction in the epitaxial growth process of pure silicon is theHydrogen reduction of silicon tetrachloride.

$$SiCl_4 + 2H_2 \xrightarrow{1200^oC} Si + 4\,HCl$$

Q8.What is the assumptions made from ideal opamp characteristics?
A8 i) the current drawn by either of the input terminals (noninverting/inverting) is negligible.
ii) The potential difference between the inverting & non-inverting input terminals is zero.

Q9. Mention some of the linear applications of op – amps?
A9. Adder, subtractor, voltage –to- current converter, current –to- voltage converters, instrumentation amplifier, analog computation, power amplifier, etc are some of the linear op-amp circuits.

Q10.Mention some of the non – linear applications of op-amps?
A10 Rectifier, peak detector, clipper, clamper, sample and hold circuit, log amplifier, anti –log amplifier, multiplier are some of the non – linear op-amp circuits.

Title of the Practical: A/D Converter

Q1.List the broad classification of ADCs?
A1 1. Direct type ADC.
2. Integrating type ADC.

Q2.List out the direct type ADCs.
A2 1. Flash (comparator) type converter
2. Counter type converter
3. Tracking or servo converter
4. Successive approximation type converter

Q3. List out some integrating type converters.
A3 1. Charge balancing ADC
2. Dual slope ADC

Q4.What is integrating type converter?
A4 An ADC converter that perform conversion in an indirect manner by first changing the analog I/P signal to a linear function of time or frequency and then to a digital code is known as integrating type A/D converter.

Q5.Explain in brief the principle of operation of successive Approximation ADC?
A5 The circuit of successive approximation ADC consists of a successive approximation register (SAR), to find the required value of each bit by trial & error.With the arrival of START command, SAR sets the MSB bit to 1. The O/P is converted into an analog signal & it is compared with I/P signal. This O/P is low or high. This process continues until all bits are checked.

Q6.What are the main advantages of integrating type ADCs?
A6 i. The integrating type of ADC's do not need a sample/Hold circuit at the input.
ii. It is possible to transmit frequency even in noisy environment or in an isolated form.

Q7.Define conversion time?
A7 It is defined as the total time required to convert an analog signal into its digital output. It depends on the conversion technique used & the propagation delay of circuit components. The conversion time of a successive approximation type ADC is given by T (n+1)

Where T---clock period
Tc---conversion time
n----no. Of bits

Q8.Define resolution of a data converter?
A8 The resolution of a converter is the smallest change in voltage which may be produced at the output or input of the converter. Resolution (in volts)= VFS/2n-1=1 LSB increment. The resolution of an ADC is defined as the smallest change in analog input for a one-bit change at the output.

Q9.Explain in brief stability of a converter?
A9 The performance of converter changes with temperature age & power supply variation. So all the relevant parameters such as offset, gain, linearity error & monotonicity must be specified over the full temperature & power supply ranges to have better stability performances.

Q10.What is meant by linearity?
A10 The linearity of an ADC/DAC is an important measure of its accuracy & tells us how close the converter output is to its ideal transfer characteristics. The linearity error is usually expressed as a fraction of LSB increment or percentage of full-scale voltage. A good converter exhibits a linearity error of less than ±½LSB.

Title of the Practical: OP-AMP as Active Filter: (a) Low pass filter (b) High pass filter (c) Band pass

Q1: What is filter?

A1: A filter circuit is a device that converts pulsating output of a rectifier into a steady dc level. Hence, it becomes essential to reduce the ripples from the pulsating dc supply available from rectifier circuits to the minimum. This is achieved by using a filter or smoothing circuit which removes (or filters out) the ac components and allows only the dc component to reach the load. Obviously, a filter circuit should be placed between, the rectifier and the load.

Q2: What is filter circuit?

A2: A filter is generally a combination of inductors L and Capacitors C. The filtering action of L and C depends upon the facts that an inductor allows only dc and a capacitor allows ac only to pass. So a suitable L and C network can effectively filter out (or remove) the ac components from the rectified output.

Q3: What are the commonly used types of filter circuits?

A3: (a) Series Inductor Filter ,(b) Shunt Capacitor Filter ,(c) Choke Input Filter, (d) Capacitor input or pie filter

Q4: Series Inductor Filter?

A4: In this arrangement a high value inductor or choke L is connected in series with the rectifier element and the load, the filtering action of an inductor filter depends upon its property of opposing any change in the current flowing through it. The function of the inductor filter may be viewed in terms of impedances. The choke offers high impedance to the ac components but offers almost zero resistance to the desired dc components. Thus ripples are removed to a large extent.

Q5: What is shunt capacitor filter?

A5: In this arrangement a high value Capacitor is connected in parallel with the rectifier element and the load, the function of the capacitor filter may be viewed in terms of impedances. The capacitor offers zero impedance to the ac components but offers high resistance to the desired dc components, so C bypasses the dc.Thus ripples are removed to a large extent

Q6: What is the drawback of series inductor and shunt capacitor filter?

A6: A simple shunt capacitor filter reduces the ripple voltage but increases the diode current. The diode may get damaged due to large current and at the same time it causes greater heating of supply transformer resulting in reduced efficiency. In an inductor filter, ripple factor increases with the increase in load resistance RL while in a capacitor filter it varies inversely with load resistance RL.From economical point of view also; neither series inductor nor shunt capacitor type filters are suitable.

Q7: What is practical filter circuit?

A7: Practical filter-circuits are derived by combining the voltage stabilizing action of shunt capacitor with the current smoothing action of series choke coil. By using combination of inductor and capacitor ripple factor can be lowered, diode current can be restricted and simultaneously ripple factor can be made almost independent of load resistance (or load current). Two types of most commonly used combinations are choke-input or L-section filter-and capacitor-input or Pi-Filter.

Q8: What is Choke-input filter?

A8: Choke-input filter consists of a choke L connected in series with the rectifier and a capacitor C connected across the load. This is also sometimes called the L-section filter The choke L on the input side of the filter readily allows dc to pass but opposes the flow of ac components Any fluctuation that remains in the current even after passing through the choke are largely by-passed around the load by the shunt capacitor However, a small ripple still remains in the filtered output and this is considered negligible if it than l%.

Q9: What is Capacitor-Input or Pi-Filter?

A9: Such a filter consists of a shunt capacitor C1 at the input followed by an L-section filter formed by series inductor L and shunt capacitor C_2. This is also called the ∏ -filter the input capacitor C1 is selected to offer very low reactance to the ripple frequency. Hence major part of filtering is accomplished by the input capacitor C1. Most of the remaining ripple is removed by the L-section filter consisting of a choke L and capacitor C_2.

Q10: Salient Features of L-Section and Pi-Filters?

A10: 1. In pi-filter the dc output voltage is much larger than that can be had from an L-section filter with the same input voltage.

2. In pi-filter ripples are less in comparison to those in shunt capacitor or L-section filter. So smaller valued choke is required in a pi-filter in comparison to that required in L-section filter.

3. In pi-filter, the capacitor is to be charged to the peak value hence the rms current in supply transformer is larger as compared in case of L-section filter.\

4. Voltage regulation in case of pi-filter is very poor, as already mentioned. So n-filters are suitable for fixed loads whereas L-section filters can work satisfactorily with varying loads provided a minimum current is maintained.
5. In case of a pi-filter PIV is larger than that in case of an L-section filter.

Title of the Practical: Clamper and chopper operation (a) Positive and Negative clamper (b) Positive and Negative clipping

Q1: What is clipper?
A1: In electronics, a clipper is a device designed to prevent the output of a circuit from exceeding a predetermined voltage level without distorting the remaining part of the applied waveform. Series clippers are employed as noise limiters in FM transmitters by clipping excessive noise peaks above a specified level.

Q2: Can you explain clipping circuit?
A2: A clipping circuit consists of linear elements like resistors and non-linear elements like junction diodes or transistors. Thus a clipper circuit can remove certain portions of an arbitrary waveform near the positive or negative peaks. Clipping may be achieved either at one level or two levels Clipping Circuits are also called as Slicers, amplitude selectors or limiters.

Q3: Clipping using Zener Diode?
A3: one or two zener diodes are used to clip the voltage V_{IN}. In the first circuit, the voltage is clipped to the reverse breakdown voltage of the zener diode. In the second, it is limited to the reverse breakdown voltage plus the voltage drop across one zener diode.

Q4: Classification of clipper?
A4: Practical clippers may be classified into two types: (a) Shunt Clippers, and (b) Series Clippers. The series configuration is defined as one where diode is in series with the load In a shunt clipper which uses a diode in conjunction with a resistor the diode forms a parallel path across the output. The network must have capacitor, a diode, and a resistive element, but it also employs an independent dc supply to introduce an additional shift.

Q5: Application of clipper?
A5: It is used in television sets and FM receivers. It is also used for amplifier and different types of op-amps through which we can do some mathematical operations.

Q6: What is positive and negative clipping?
A6: Depending on the orientation of the diode, the positive or negative region of the input signal is “clipped” off and accordingly the diode clippers may be positive or negative clippers.

Q7: What is Positive Clipper circuit?
A7: Positive Clipper: The clipper which removes the positive half cycles of the input voltage is called the positive clipper. The positive series clipper circuit (that is, diode in series with the load). while the input is positive, diode D is reverse biased and so the output remains at zero that is, positive half cycle is clipped off. During the negative half cycle of the input, the diode is forward biased and so the negative half cycle appears across the output.

Q8: What is negative clipper circuit?
A8: If the positive clipper circuit is reconnected with reversed polarity, the circuits will become for a negative clipper and the operation will be same.

Q9: What is Combination Clipper?
A9: When a portion of both positive and negative of each half cycle of the input voltage is to be clipped (or removed), combination clipper is employed.

Q10: Drawbacks of Series Diode Clippers?
A10: In series clippers, when diode is in ‘off’ position, there should be no transmission of input signal to output. But in case of high frequency signals transmission occurs through diode capacitance which is undesirable. This is the drawback of using diode as a series element in such clippers.

Title of the Practical: Oscillator using OP-AMP: (a) Wien Bridge Oscillator (b) R.C. Phase Shift Oscillator

Q1: What are oscillators?
A1: Oscillators produce a waveform (mostly sine or square waves) of desired amplitude and frequency. They can take input from the output itself. For a complete oscillator circuit we require a feedback device, amplifier and feedback factor. Oscillators designed to produce a high-power AC output from a DC supply are usually called inverters

Q2: Application of electronic oscillator?
A2: An electronic oscillator is an electronic circuit that produces a repetitive electronic signal, often a sine wave or a square wave. They are widely used in innumerable electronic devices. Common examples of signals generated by oscillators include signals broadcast by radio and television transmitters, clock signals that regulate computers and quartz clocks, and the sounds produced by electronic beepers and video games.

Q3: Types of electronic oscillator?
A3: There are two main types of electronic oscillator: the harmonic oscillator and the relaxation oscillator.

Q4: What is Harmonic oscillator?
A4: The harmonic, or linear, oscillator produces a sinusoidal output. The basic form of a harmonic oscillator is an electronic amplifier with the output attached to an electronic filter, and the output of the filter attached to the input of the amplifier, in a feedback loop. When the power supply to the amplifier is first switched on, the amplifier's output consists only of noise. The noise travels around the loop, being filtered and re-amplified until it increasingly resembles the desired signal.

Q5: Types of Harmonic oscillator?
A5: There are many ways to implement harmonic oscillators, because there are different ways to amplify and filter. Some of the different circuits are:

- Hartley oscillator
- Colpitts oscillator
- Cross-coupled LC oscillator
- crystal oscillator
- Phase-shift oscillator
- RC oscillator (Wien Bridge and "Twin-T")
-

Q6: What are LC oscillators?
A6: Inductive oscillators also known as LC oscillators are built of an tank circuit, which oscillates by charging and discharging a capacitor through an inductor. These oscillators are typically used when a tunable precision frequency source is necessary, such as with radio transmitters and receivers

Q7: What is phase-shift oscillator?
A7: A phase-shift oscillator is a simple electronic oscillator. It contains an inverting amplifier, and a feedback filter which 'shifts' the phase of the amplifier output by 180 degrees at the oscillation frequency. The filter produces a phase shift that increases with frequency. It must have a maximum phase shift of considerably greater than 180° at high frequencies, so that the phase shift at the desired oscillation frequency is 180°.

Q8: How to produced 180° phase shift?
A8: The most common way of achieving this kind of filter is using three identical cascaded resistor-capacitor filters, which together produce a phase shift of zero at low frequencies, and 270 degrees at high frequencies. At the oscillation frequency each filter produces a phase shift of 60 degrees and the whole filter circuit produces a phase shift of 180 degrees.

Q9: Mathematics for calculating the oscillation frequency?
A9: The mathematics for calculating the oscillation frequency and oscillation criterion for this circuit is surprisingly complex, due to each R-C stage loading the previous ones. The calculations are greatly

simplified by setting all the resistors (except the negative feedback resistor) and all the capacitors to the same values, if R1 = R2 = R3 = R, and C1 = C2 = C3 = C, then:

$$f_{\text{oscillation}} = \frac{1}{2\pi RC\sqrt{6}}$$

And the oscillation criterion is:

$R_{feedback}$= 29(R)

Q10: How to implement the phase-shift oscillator?

A10: A version of this circuit can be made by putting an op-amp buffer between each R-C stage which simplifies the calculations. The voltage gain of the inverting channel is always unity.

Title of the Practical: Schmitt Trigger. OP-AMP and Timer IC (a) Saw tooth wave generator (b) Ramp generator

Q112.What is the applications of 555 Timer?

A112 · astable multivibrator
· Monostable multivibrator
· Missing pulse detector
· Linear ramp generator
· Frequency divider
· Pulse width modulation
· FSK generator
· Pulse position modulator
· Schmitt trigger

Q2.List the applications of 555 timers in monostable mode of operation:

A2. *missing pulse detector
*Linear ramp generator
*Frequency divider
*Pulse width modulation.

Q3. List the applications of 555 timers in Astable mode of operation:

A3 *FSK generator
*Pulse-position modulator

Q4.Define 555 IC?

A4 The 555 timer is an integrated circuit specifically designed to perform signal generation and timing functions.

Q5.List the basic blocks of IC 555 timers?

A5· A relaxation oscillator
· RS flip flop
· Two comparator
· Discharge transistor.

Q6.List the features of 555 Timer?

A6 · It has two basic operating modes: monostable and astable
· It is available in three packages. 8 pin metals can, 8 pin dip, 14 pin dip.
· It has very high temperature stability.

Q7.Define duty cycle?

A7 The ratio of high output and low output period is given by a mathematical parameter called duty cycle. It is defined as the ratio of ON Time to total time.

Q8.Define VCO.

A9 A voltage controlled oscillator is an oscillator circuit in which the frequency of oscillations can be controlled by an externally applied voltage.

Q9.List the features of 566 VCO.

A9· Wide supply voltage range (10-24V)
· Very linear modulation characteristics
· High temperature stability

10. What does u mean by PLL?

A PLL is a basically a closed loop system designed to lock output frequency and
Phase to the frequency and phase of an input signal.

11. Define lock range.

Title of the Practical: Non-Inverting Amplifier (a) AC Analysis (b) DC Analysis (c) Unity Gain Buffer

Q1.What is the areas of application of non-linear op- amp circuits?
A1 1.industrial instrumentation,
2. Communication
3. Signal processing

Q2.What happens when the common terminal of V+ and V- sources is not grounded?
A2 If the common point of the two supplies is not grounded, twice the supply voltage Will get applied and it may damage the op-amp.

Q3.Define input offset voltage.
A3.A small voltage applied to the input terminals to make the output voltage as zero when the two input terminals are grounded is called input offset voltage.

Q4. Define input offset current. State the reasons for the offset currents at the input of the Op-amp.?
A4.The difference between the bias currents at the input terminals of the op-amp is called as input offset current. The input terminals conduct a small value of dc current to bias the input transistors. Since the input transistors cannot be made identical, there exists a difference in bias currents.

Q5. Define CMRR of an op-amp.
A5 The relative sensitivity of an op-amp to a difference signal as compared to a Common –mode signal is called the common –mode rejection ratio. It is expressed in decibels.

$$CMRR = A_d/A_c$$

Q6.In practical op-amps, what is the effect of high frequency on its performance?
A6 The open-loop gain of op-amp decreases at higher frequencies due to the Presence of parasitic capacitance. The closed-loop gain increases at higher frequencies and leads to instability.

Q7. What is the need for frequency compensation in practical op-amps?
A7 Frequency compensation is needed when large bandwidth and lower closed loop gain is desired. Compensating networks are used to control the phase shift and hence to improve the stability.

Q8. Mention the frequency compensation methods.
A8 1. Dominant-pole compensation
2. Pole-zero compensation.

Q9.What is the merits and demerits of Dominant-pole compensation?
**A9 ***noise immunity of the system is improved.
*Open-loop bandwidth is reduced.

Q10 .Define slew rate.
A10 The slew rate is defined as the maximum rate of change of output voltage caused By a step input voltage. An ideal slew rate is infinite which means that op-amp's output Voltage should change instantaneously in response to input step voltage.

Title of the Practical: Preparation of Adjustable timer using OP-AMP

Q1.Why IC 741 is not used for high frequency applications?
A1 IC741 has a low slew rate because of the predominance of capacitance present in the circuit at higher frequencies. As frequency increases the output gets distorted due to limited slew rate.

Q2.What causes slew rate?
A2 There is a capacitor with-in or outside of an op-amp to prevent oscillation. It is this capacitor which prevents the output voltage from responding immediately to a fast changing input.

Q3 .Define thermal drift?
A3 The bias current, offset current & offset voltage change with temperature. A circuit carefully nulled at 25oC may not remain so when the temperature raises to 35oC.This is called thermal drift. Often, offset current drift is expressed in nA / oC and offset voltage drift in mV/ oC.

Q4.Define supply voltage rejection ratio (SVRR)?
A.4 The change in OPAMP's input offset voltage due to variations in supply voltage is called the supply voltage rejection ratio. It is also called Power Supply Rejection Ratio (PSRR) or Power Supply Sensitivity (PSS).

Q5 .What is the need for an instrumentation amplifier?
Q5 In a number of industrial and consumer applications, the measurement of physical quantities is usually done with the help of transducers. The output of transducer has to be amplified So that it can drive the indicator or display system. This function is performed by an instrumentation amplifier.

Q6.List the features of instrumentation amplifier:
A6 1.high gain accuracy
2. High CMRR
3. High gain stability with low temperature co-efficient
4. Low dc offset
5. Low output impedance

Q7.What is a comparator?
A7 A comparator is a circuit which compares a signal voltage applied at one input of an op-amp with a known reference voltage at the other input. It is an open loop op - amp with output + Vsat.

Q8.What is the applications of comparator?
A8 1. Zero crossing detectors
2. Window detector
3. Time marker generator
4. Phase detector

Q9.What is a Schmitt trigger?
A9 Schmitt trigger is a regenerative comparator. It converts sinusoidal input into a square wave output. The output of Schmitt trigger swings between upper and lower threshold voltages, which are the reference voltages of the input waveform.

Q10.What is a multivibrator?
A10 Multivibrators are a group of regenerative circuits that are used extensively in timing applications. It is a wave shaping circuit which gives symmetric or asymmetric square output. It has two states stable or quasi- stable depending on the type of multivibrator.

Title of the Practical: Precision Rectifier using an OP-AMP and voltage regulations.

Q1: What is the rectifier?
A1: The process of converting A.C. voltage into D.C. voltage which is in only one direction, a process known as rectification is called rectification and it is done by rectifier.
Q2: What is the application of rectifier?
A2: Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components. Rectifiers also find a use in detection of amplitude modulated radio signals
Q3: What is the type of rectifier?
A3: There are two type of rectifier:-
1. Half wave rectifier 2. Full wave rectifier:- center tape full wave
Bridge full wave
Q4: What is the ripple factor of the rectifier?
A4: The ripple factor of the rectifier: - Half wave recitifer:-1.21, Center tape wave rectifier:-0.48
Bridge full wave:-0.48
Q5: What is the PIV of all type rectifiers?
A5: The PIV of rectifier: - Half wave rectifier=Vm, Center tape wave rectifier=2Vm
Bridge full wave=Vm
Q6: Half wave rectifier?
A5: In a half wave rectifier only one half cycle of ac voltage is taking. The circuit is given. Here only one diode is using. During the positive half cycle of ac voltage the diode conducts. So current flows through load. During the negative half cycle, the diode is reverse biased .So no current flows through the diode. Half-wave rectification can be achieved with a single diode in a one-phase supply, or with three diodes in a three-phase supply.
Q7: Full wave bridge rectifier?
A7: Full wave bridge rectifier: In full wave bridge rectifiers 4 diodes are using. During positive half cycle, D1 and D4 are in forward biased condition. In the negative half cycle of ac D3 and D2 are in forward biased condition. So in both the half cycles current through the load is in single direction. This circuit does not need a centre tap rectifier. But it requires more number of diodes than centre tap and half wave rectifiers
Q8: Full wave centre tap rectifier?
A8: In this method only two diodes are using. But it requires a center tap transformer. During the positive half cycle diode D1 conducts. In the negative half cycle diode D2 conducts. So in both half cycles current flowing through load in same direction. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient.
Q9: Why we use Filter?
A9: While half-wave and full-wave rectification suffice to deliver a form of DC output, neither produces constant-voltage DC. In order to produce steady DC from a rectified AC supply, a smoothing circuit or filter is required. In its simplest form this can be just a reservoir capacitor or smoothing capacitor, placed at the DC output of the rectifier. There will still remain an amount of AC ripple voltage where the voltage is not completely smoothed.
Q10: Difference between half wave and full wave rectifier?
A10: The efficiency of half wave rectifier is not so good as that of full wave rectifier Because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer. The ripples are maximum in the single phase half-wave rectifier and being reduced in the full-wave rectifier and being reduced further with the increase in the number of phases.

Title of the Practical: Measurement VCD sensitivity linearity & free running frequency.

Q1. What do you mean by monostable multivibrator?
A1 Monostable multivibrator is one which generates a single pulse of specified duration in response to each external trigger signal. It has only one stable state. Application of a trigger causes a change to the quasi-stable state. An external trigger signal generated due to charging and discharging of the capacitor produces the transition to the original stable state.

Q2 .What is an astable multivibrator?
A2 Astable multivibrator is a free running oscillator having two quasi-stable states. Thus, there are oscillations between these two states and no external signals are required to produce the change in state.

Q3.What is a bistable multivibrator?
A3 Bistable multivibrator is one that maintains a given output voltage level unless an external trigger is applied. Application of an external trigger signal causes a change of state, and this output level is maintained indefinitely until a second trigger is applied. Thus, it requires two external triggers before it returns to its initial state

Q4.What is the requirements for producing sustained oscillations in feedback circuits?
A4 For sustained oscillations,
1. The total phase shift around the loop must be zero at the desired frequency of oscillation, fo. ie, LAB =0 (or) 360°
2. At fo, the magnitude of the loop gain | A b | should be equal to unity

Q5.What is the different types of filters?
A5 Based on functions: Low pass filter, High pass filter, Band pass filter, Band reject filter
Based on order of transfer function: first, second, third higher order filters.
Based on configuration: Bessel, Chebychev, Butterworth filters.

Q6.What is a sample and hold circuit? Where it is used?
A6 A sample and hold circuit is one which samples an input signal and holds on to its last sampled value until the input is sampled again. This circuit is mainly used in digital interfacing, analog to digital systems, and pulse code modulation systems.

Q7.Define sample period and hold period?
A7 The time during which the voltage across the capacitor in sample and hold circuit is equal to the input voltage is called sample period. The time period during which the voltage across the capacitor is held constant is called hold period.
Q8: Why use Monostable Multivibrators?
A9. Monostable Multivibrators deliver a single output pulse when it is triggered externally only returning back to its first original and stable state after a period of time determined by the time constant of the RC coupled circuit.

Q9: Disadvantage of Monostable Multivibrators?
A9: One main disadvantage of Monostable Multivibrators is that the time between the applications of the next trigger pulse has to be greater than the preset RC time constant of the circuit to allow the capacitor time to charge and discharge

Q10: Application of Monostable Multivibrators?
A10: Monostable Multivibrators can therefore be considered as triggered pulse generators and are generally used to produce a time delay within a circuit as the frequency of the output signal is the same as that for the trigger pulse input the only difference being the pulse width.

Title of the Practical: Calculate the duty cycle of PWM.

Q1.What is a voltage regulator?
A1 A voltage regulator is an electronic circuit that provides a stable dc voltage independent of the load current, temperature, and ac line voltage variations.

Q2.Give the classification of voltage regulators:
A2 *Series / Linear regulators
*Switching regulators.

Q3.What is a linear voltage regulator?
A3 Series or linear regulator uses a power transistor connected in series between the unregulated dc input and the load and it conducts in the linear region .The output voltage is controlled by the continuous voltage drop taking place across the series pass transistor.

Q4.What is a switching regulator?
A4 Switching regulators are those which operate the power transistor as a high frequency on/off switch, so that the power transistor does not conduct current continously.This give improved efficiency over series regulators.

Q5.What is the advantages of IC voltage regulators?
A5 *low cost
*high reliability
*reduction in size
*excellent performance

Q6.Give some examples of monolithic IC voltage regulators:
A6 78XX series fixed output, positive voltage regulators
79XX series fixed output, negative voltage regulators
723 general purpose regulators.

Q7.What is the purpose of having input and output capacitors in three terminal IC Regulators?
A7 A capacitor connected between the input terminal and ground cancels the inductive effects due to long distribution leads. The output capacitor improves the transient response.

Q8. Define line regulation.
A8 Line regulation is defined as the percentage change in the output voltage for a change in the input voltage. It is expressed in millionths or as a percentage of the output voltage.

Q9.Define load regulation.
A9 Load regulation is defined as the change in output voltage for a change in load current. It is expressed in millivolts or as a percentage of the output voltage.

Q10.What is meant by current limiting?
A10 Current limiting refers to the ability of a regulator to prevent the load current from Increasing above a preset value.

Title of the Practical: OP-AMP as: (a) Adder (b) Subtractor (c) Multiplier (d) Divider

Q1.Give the drawbacks of linear regulators:

A1 *the input step down transformer is bulky and expensive because of low line frequency.
*Because of low line frequency, large values of filter capacitors are required to decrease the ripple.
*Efficiency is reduced due to the continuous power dissipation by the transistor as it operates in the linear region.

Q2.What is the advantage of switching regulators?

A2 *Greater efficiency is achieved as the power transistor is made to operate as low impedance switch. Power transmitted across the transistor is in discrete pulses rather than as a steady current flow.
*By using suitable switching loss reduction technique, the switching frequency can be increased so as to reduce the size and weight of the inductors and capacitors.

Q3.What is an opto-coupler IC?

A3 Opto-coupler IC is a combined package of a photo-emitting device and a photo sensing device.

Q4.What is the types of opto couplers?

A4· LED and a photo diode,
· LED and photo transistor,
· LED and Darlington.

Q5.Give two examples of IC optocouplers?

A5 Examples for opto-coupler IC
MCT 2F
MCT 2E.

Q6. Mention the advantages of opto-couplers:

A6 *Better isolation between the two stages.
*Impedance problem between the stages is eliminated.
*Wide frequency response.
*Easily interfaced with digital circuit.
*Compact and light weight.
*Problems such as noise, transients, contact bounce, are eliminated.

Q7.What is an isolation amplifier?

A7 An isolation amplifier is an amplifier that offers electrical isolation between its input and output terminals.

Q8.What is the features of isolation amplifier?

A8 · Easy to use
· Ultra low leakage
· 18 pin DIP package

Q9. What is LM380?

A9It is a power amplifier produced by national semiconductor. It is capable of delivering 2.5 W min, to 8 ohm load.

Q10.What is the features of MA78s40?

A10 · Step up, step down or inverting operation
· Operation from 2.5 to 40 V.
· 80Db line and load regulation.

Title of the Practical: OP-AMP as: OP-AMP as: (a) Integrator (b) Differentiator (c) Inverter (d) Buffer

Q1. Define capture range.

A1 The range of frequencies over which the PLL can acquire lock with the input signal is called as capture range.

Q2. Define pull-in time.

A2 The total time taken by the PLL to establish lock is called pull-in time.

Q3. List the applications of 565 PLL.

A3 · Frequency multiplier
· Frequency synthesizer
· FM detector

Q4. What are the two types of analog multiplier Ics?

A4 a) IC AD 533
b) IC AD 534

Q5. What is ICAD 533?

A5 It is a multiplier IC by analog devices. It is a low cost IC comprising a Trans conductance multiplying element, stable reference and an output amplifier.

Q6. List the features of ICAD533.

A6 · its operation is very simple.
· Only 4 external adjustments are necessary
· Maximum 4 quadrant error is below 0.5%

Q7. What is ICAD 534?

A7 It is a multiplier IC by analog devices. It is the first general purpose multiplier capable of providing gain upto X100.

Q8. List the features of ICAD534.

A8 · Adjustable scale factor
· Low noise
· Excellent long time stability

Q9. List the few applications of ICAD534.

A9 · Multiplier
· Divider
· High quality signal processing

Q10: What is the time period of monostable multivibrator?

A10 The time of period monostable multivibrator remains in unstable state is given by t = ln (2) R2C1. If repeated application of the input pulse maintains the circuit in the unstable state, it is called a retrigger able monostable. If further trigger pulses do not affect the period, the circuit is a non-retrigger able multivibrator.